

# BIOL 331:

# Introduction to Cellular & Molecular Biology

## Learning Outcomes

01

Explain how macromolecules interact to support cell structure, function, dynamics and responses to environmental signals.

Describe the evolutionary diversity of cells, and how this diversity contributes to tissue and whole organism function.

02

03

Apply knowledge and technical understanding of cell and molecular biology to interpret experimental data.

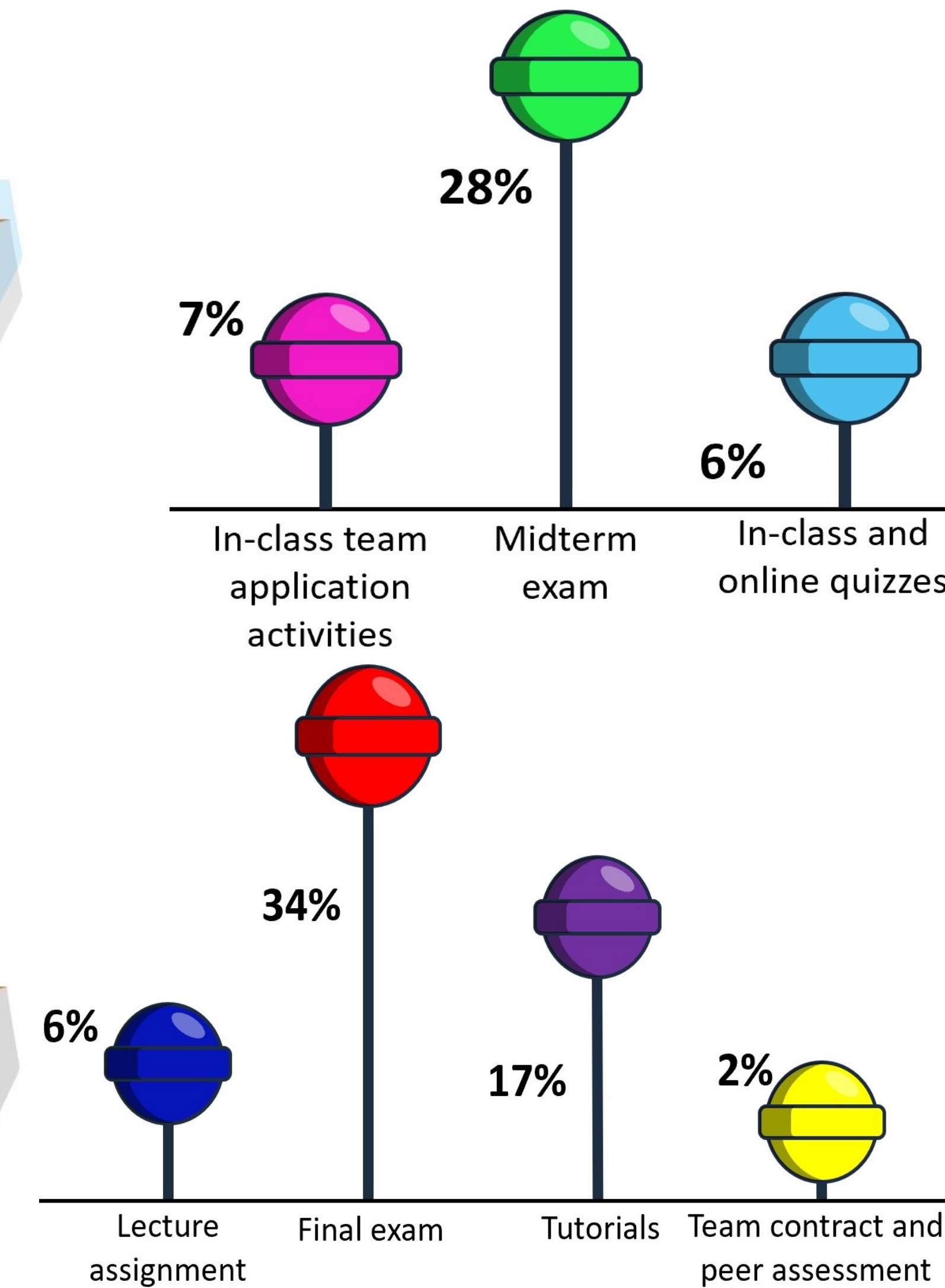


## Teaching Team

| Position       | Name                     | Email  | Office  | Office Hours |
|----------------|--------------------------|--|---------|--------------|
| Instructor     | Dr. Isabelle Barrette-Ng | <a href="mailto:mibarret@ucalgary.ca">mibarret@ucalgary.ca</a>                   | BI 430A |              |
| Instructor     | Dr. John Cobb            | <a href="mailto:jacobb@ucalgary.ca">jacobb@ucalgary.ca</a>                       | BI 286D |              |
| Instructor     | Dr. Doug Muench          | <a href="mailto:dmuench@ucalgary.ca">dmuench@ucalgary.ca</a>                     | BI 399  |              |
| Student Helper | Nia Abdullayeva          | <a href="mailto:nigar.abdullayeva@ucalgary.ca">nigar.abdullayeva@ucalgary.ca</a> |         |              |
| Student Helper | Muznah Abrar             | <a href="mailto:muznah.abrar@ucalgary.ca">muznah.abrar@ucalgary.ca</a>           |         |              |
| Tutorial TA    | T__ _                    |  |         |              |

## Course Themes

1. Cells are functional units of life.
2. Cellular membranes are critical to biological processes in the cell.
3. Protein synthesis and the endomembrane system.
4. Different types of vesicles allow for anterograde and retrograde transport.
5. The cytoskeleton of a cell is important for vesicular transport.
6. Plant cell biology.
7. Interactions between cells and the environment.
8. Cell communication
9. Control of gene expression and reprogramming.
10. Cancer and what protects us.



| Letter Grade | Min. % Required |
|--------------|-----------------|
| A+           | 91              |
| A            | 86              |
| A-           | 81              |
| B+           | 76              |
| B            | 71              |
| B-           | 67              |
| C+           | 63              |
| C            | 59              |
| C-           | 55              |
| D+           | 50              |
| D            | 45              |

| Readings  | Lecturer(s)     | Class  |   | Tutorial  |
|---|-----------------|--|---|---|
| N/A   | Dr. Barrette-Ng | Jan 13   | Why is studying cell and molecular biology important? How can you succeed in this course?   | No tutorial during week of January 13, 2020.  |
| Ch. 1   |                 | 15   | Getting into teams and drafting team contracts (worth 1%)   |   |
|   |                 | 17   | Practice RAT on basic functions of cells (worth 1%; pass/fail only)   |   |
| 4.1-4.4, 4.6  |                 | 20   | iRAT and tRAT quiz #1 – Membrane composition (worth 1%)   | No tutorial during week of January 20, 2020.  |
|   |                 | 22   | Membrane composition, asymmetry, and fluidity   |   |
|   |                 | 24   | Team application activity #1 – Membrane physicochemical properties (worth 1%)   |   |
| 4.9-4.14  |                 | 27   | iRAT and tRAT quiz #2 – Membrane proteins (worth 1.5%)  | Tutorial #1 during week of January 27, 2020.<br>Topics: Reviewing team contracts and foundational molecular biology knowledge (worth 1%)                  |
|   |                 | 29   | Applying our knowledge: deeper examination of peripheral and lipid-anchored membrane proteins<br>Introduction to membrane transport   |   |
|   |                 | 31   | Team application activity #2 – membrane transport (worth 1.5%)  |   |
| 4.16-4.17   |                 | 3  | iRAT and tRAT quiz #3 – Active membrane transport (worth 1.5%)  | Tutorial #2 during week of February 3, 2020.<br>Topics: Isolating and studying membrane protein mobility (worth 2%)                                       |
|   |                 | Feb 5  | Action potentials   |   |
| portions of 8.1, 8.3, 8.8, 8.9, 8.10, 8.13, 8.14, and 8.19  |                 | 7  | Introduction to the endomembrane system (completion of reading and online quiz prior to coming to class is required; worth 1%)<br>Team application activity #3 – applying our knowledge on the endomembrane system (worth 1%) | Tutorial #3 during week of February 10, 2020.<br>Topics: Membrane potentials and ion channels (worth 2%)  |
| portions of 8.4, 8.6, and 8.7   |                 | 10   | Protein synthesis, glycosylation, transport and quality control   |   |
| portions of 8.9, 8.10, and 8.11   |                 | 12   | Traffic between the RER and Golgi   |   |
|   |                 | 14   | Traffic beyond the Golgi<br>Team application activity #4 – applying our knowledge on cellular traffic (worth 1%)  |   |
|   |                 | 17-21  | <b>READING WEEK</b>   |   |
| portions of 9.1, 9.2, 9.3, 9.5, 9.6, 9.10, and 9.11   |                 | 24   | Vesicular transport and the cytoskeleton (completion of reading and online quiz prior to coming to class is required; worth 1%)   | Tutorial #4 during week of February 24, 2020.<br>Topics: Subcellular fractionation, differential centrifugation, and fluorescence microscopy (worth 2%)   |
|   | 26              | Team application activity #5 – synthesizing our knowledge (worth 1.5%) |   |   |
| Part 1: pages 323-325; section 9.6<br>Part 2: pages 142, 254, 255, 570, 571; sections 4.10, 7.14, 14.11<br>Part 3: pages 250-251, 292, 293; sections 7.12, 8.16 | Dr. Muench      | 28   | Plant cell biology I  | Tutorial #5 during week of March 2, 2020.<br>Topics: Endocytosis, exocytosis and vesicular transport (worth 2%)   |
|   |                 | Mar 2  | Plant cell biology II   |   |
|   |                 | 4  | Plant cell biology III  |   |
| 12.3, 12.4, 12.7, 12.9, 1.6, 7.0-7.8, 7.10-7.12 (not plasmodesmata)   | Dr. Cobb        | 6  | DNA organization and chromosome structure, epigenetics  | Tutorial #6 during week of March 9, 2020.<br>Topics: Electron microscopy and antibody labelling (worth 2%)  |
|   |                 | 7  | <b>MIDTERM 5-7pm</b>  |   |
|   |                 | 9  | Stem cells, therapeutic and reproductive cloning  |   |
|   |                 | 11   | Cell-cell interactions  |   |
|   |                 | 13   | Cell-junctions I & II   |   |
| 15.1-15.3, 15.6, 15.7, 15.10, 15.11, 15.15  | Dr. Cobb        | 16   | Extracellular matrix  | Tutorial #7 during week of March 16, 2020.<br>Topics: Gap junctions and tight junctions (worth 2%)  |
|   |                 | 18   | Introduction to intercellular signaling   |   |
|   |                 | 20   | Cell signaling: G proteins & cAMP pathway   |   |
|   |                 | 23   | Cell signaling: IP3/Ca <sup>2+</sup> /PKC pathways  |   |
| 12.14, 12.15, 12.17, 14.1, 14.2, 14.4   | Dr. Cobb        | 25   | Cell signaling: Receptor tyrosine kinases   | Tutorial #8 during week of March 23, 2020.<br>Topics: Matrix metalloproteases, scratch migration assays, Boyden chamber assays, and zymography (worth 2%) |
|   |                 | 27   | Gene regulation and steroid hormones  |   |
|   |                 | 30   | Regulation of the cell cycle: I   |   |
| 14.5, 15.17, 16.1, 16.2, 16.4-16.9  | Dr. Cobb        | Apr 1  | Regulation of the cell cycle: II  | Tutorial #9 during week of March 30, 2020.<br>Topics: Gene expression profiling and cell-based assays (worth 2%)  |
|   |                 | 3  | DNA damage and cell cycle checkpoints   |   |
|   |                 | 6  | Apoptosis   | No tutorial during week of April 6, 2020.   |
|   |                 | 8  | Cell biology of cancer: introduction  |   |
|   |                 | 10,13  | No Lecture 😊  |   |
|   | 15              | Tumor suppressors, proto-oncogenes and oncogenes                       | No tutorial during week of April 13, 2020.  |   |